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Moderating influences on the ERM Maturity-Performance Relationship

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Abstract

Enterprise Risk Management (ERM) focuses on the elevation of risk management to the center of the firm's strategic activities. Risks are treated both as exposures to be managed and opportunities to be exploited. This study examines the firm performance implications of ERM maturation and more specifically firm characteristics that serve to engender or inhibit these performance implications. We find that in general ERM maturation increases firm value and return on assets and the impact is moderated by stakeholder related factors such as innovation intensity and knowledge focused industry structures. Additionally, we show that a firm's complexity moderates the effect of ERM valuation over the long term.

Keywords: ERM Maturity; Enterprise Risk Management; ERM

1. Introduction

Enterprise Risk Management (ERM) research has recently gained momentum and popularity amongst academics and practitioners alike.[1] Evidence has emerged of positive valuation and performance effects for firms currently implementing this enterprise-wide form of risk management. While some academic researchers, such as McShane et al. (2011), have shown little in the way of valuation implications for firms that have adopted ERM practices, most have found that there is indeed a valuation premium being realised by firms undertaking the ERM journey (e.g., Baxter et al., 2013; Farrell and Gallagher, 2014; Hoyt and Liebenberg, 2011).

The potential mediating and moderating variables between ERM and value creation has, however, received little academic enquiry to date. Kraus and Lehner (2012) carried out a careful literature review and concluded that the maturity of the body of knowledge on ERM is still in a pre-paradigmatic state and quantitative approaches are too early and thus may perhaps miss some important mediator and moderator variables between ERM and value creation. In this empirical study we explicitly examine the potential moderating effects of both stakeholder relationships (and thus enhanced firm-specific investment) and firm complexity, on the ERM maturity-performance relationship. We model the relationships from both a recent historical returns perspective (using accounting return on assets) and a future market expectation outlook (using Tobin's Q as a firm value proxy).

[1] See Kraus and Lehner (2012) for a detailed summary of academic papers in this emerging field. Additional highly relevant papers since Kraus' 2012 paper include: Beasley et al. (2015); Eckles et al. (2014); Farrell and Gallagher (2014); Grace et al. (2014); Baxter et al. (2013).

1.1 ERM: Competitive Advantage and Opportunity Exploitation

As discussed above, ERM should act as an 'opportunity facilitator' eventually leading to competitive advantage, but the question arises – how specifically can ERM achieve this goal? One of the key 'enablers' put forward by ERM is that the holistic approach to viewing the organization's risks in a portfolio context allows the board to more easily achieve an overall birds-eye view of current risk exposures. More specifically, within an ERM context, an understanding of the remaining residual risk, after allowing for natural hedges and compounding risks that may exist, is achieved.[2] This increased risk transparency at the top of the organization not only helps the key decision-makers to make more effective risk-adjusted strategic corporate decisions, but also aids in engendering good governance eventually creating a heightened risk culture permeating throughout the organization. Farrell and Gallagher (2014) focused on the valuation implications of attributes that make up an ERM program and found that the extent and level of executive support for ERM, and the resulting organizational risk culture, was a significant and important facet of the ERM value creation process.

ERM therefore acts as an integrated mechanism and framework through which the organization can scan the evolving landscape, in terms of emerging threats and opportunities. The organisation can then pro-actively re-position the firm such that the overall enterprise is in a more optimal position with overall risk and return goals set within the pre-defined risk tolerance and appetite levels (COSO, 2012).

If the ultimate goal of ERM is one of value creation then it seems reasonable that an organization should seek to achieve a competitive advantage through the ERM-derived superior risk competencies. This includes an improvement in risk-return transparency, at the top of the organization, as well as risk culture permeation throughout the entity. However, there are also more specific approaches within the ERM framework which can serve to provide the appropriate structure and improved level of transparency (and hence trust) to help achieve value creation.

These more specific competitive advantages often stem from improved stakeholder relationships. Examples of these include the ability to make use of allies to help reduce risk and uncertainty. As an example, Clarke and Varma (1999) highlight the use of a local partner in an overseas joint venture and using the ally's insights into local culture and procedures to help reduce uncertainty. Furthermore they contend that working closely with regulatory stakeholders can leverage relationships to influence law and regulation. On the latter point they highlight the example of accounting firm working with regulators to have derivatives activities disclosed in annual reports in order to protect themselves from shareholder lawsuits. A further specific example of ERM leading to competitive advantage, that has gained momentum over the last decade, is the ability to leverage data to provide enhanced analytical capability and therefore potential business rival supremacy (Davenport, 2006).

[2] See McShane et al. (2011) for discussions of natural hedges and residual risk within the ERM context.

As ERM focuses on 'breaking down silos', systematically aggregating information into a consistent framework, uncovering risk dependencies and exploiting natural hedges; the end result is a natural setting conducive to gaining value through analytical insight across many areas of the organization. As an example, the marketing department within an insurance company may liaise better with other functions such as claims and pricing, eventually leading to a better understanding of customers and hence enhancing their ability to effectively target new (and maintain existing) customers.[3]

1.2 ERM and Firm Complexity

Many internal and external variables have been attributed as having driven the need for a holistic integrated approach to risk management over the last number of years (Lam, 2001; Perrin et al, 2000; Aabo et al., 2005; Dickinson, 2001). Chief amongst these drivers are globalisation, technological progress and increasing firm complexity.

One of the key aspects of the ERM framework is the uncovering, monitoring and, where appropriate, exploitation of risks across the organization. For the less complex organization, risks may exist in "plain sight" such that the returns to the implementation of sophisticated risk management solutions may be more muted. In contrast, for the multifaceted organization that is geographically and industrially complex, strategic coordination challenges are ever present. As a consequence, we contend that efforts to integrate an enterprise-wide risk management agenda are more likely to lead to the uncovering of risk dependencies, management of said dependencies and exploitation of risks in a manner that leads to improved performance outcomes. Prior research has in fact found that ERM adoption is positively associated with increasing firm complexity, suggesting a recognition of the greater need to integrate risk management for these organizations (Kleffner et al., 2003; Beasley et al., 2005; Hoyt and Liebenberg, 2011).

1.3 Risk Management and Firm Performance

Various justifications have emerged for the adoption of ERM. The varied rationales put forward for ERM include: better optimised risk-return decision making, more efficient capital allocation, decreased earnings (and stock-price) volatility, creation of synergies between different risk management activities, cost savings from avoidance of duplication of risk management outlay, improved senior management and board oversight of risk, improved credit ratings and enhanced risk insight.[4]

On a more general risk management level, and from a strategic perspective, the favourable effects and outcomes from risk management can be viewed from three distinct theoretical contexts (Anderson, 2008).

[3] E.g. by modelling customer churn rates.

[4] Farrell and Gallagher (2014) highlight and summarise the supporting research for the arguments for the positive effects of risk management at the firm level.

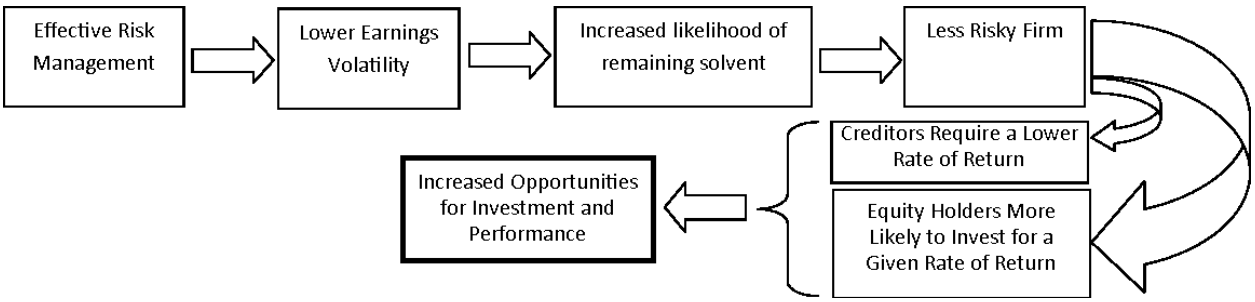
As noted by Anderson (2008) there are three key rationales that have emerged that substantiate the notion of positive risk management effects from the more stable earnings environment that risk management provides.

1. Reduced average cost of capital

A rational credit provider will justifiably expect a higher rate of return from a more risky firm, and a lower return from a less risk exposed one (Brealey et al., 2011). This is a basic premise of investment and results in firms being able to utilize risk management as a discipline through which savings can be attained via reduction of the firm's cost of capital.

To achieve this, it is important that the organization is able to adequately convey the effectiveness and benefits of their risk management efforts to outsiders. As ERM focuses on risk aggregation and transparency it is deemed to be particularly effective at accomplishing this objective (Berry-Stölzlea and Xu, 2013). Furthermore, equity holders benefit from the risk management induced lowering of earnings and returns volatility, by having greater certainty around their future cashflows, and hence they should therefore ultimately be more willing to invest in the firm at a given projected rate of return. These relationships, and resulting firm benefits, are summarised in figure 1 below.

Figure 1: Risk Management Effect on the Cost of Capital



2. Increased counter-party transaction costs

Anderson (2008) highlights the importance of maintaining strong stakeholder relationships since the neglecting of many of these affiliations and alliances can eventually lead to considerable cumulative costs.

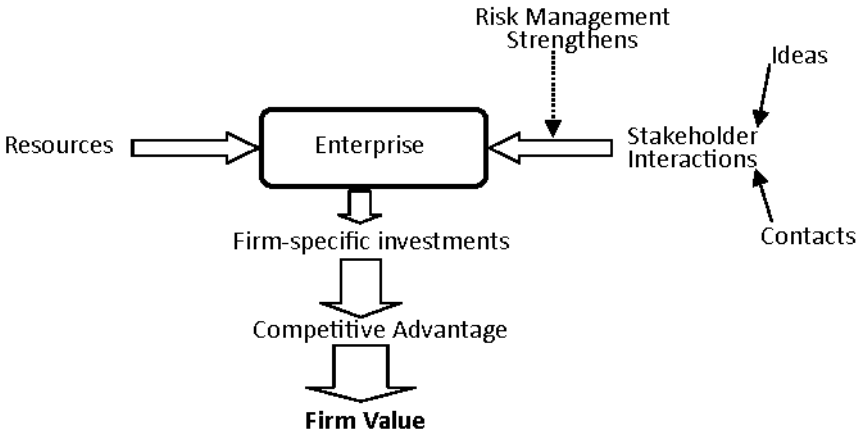
A risky business environment, with volatile earnings and returns, results in scenarios where the contractual counterparts to business transactions require a higher compensation to engage with the firm. Stakeholder relationships can be potentially jeopardised in an environment lacking in effective risk management.

It is, therefore, argued that effective risk management helps to strengthen key associations by encouraging the stakeholder partners to, for example, offer favourable terms (e.g. suppliers) and invest efforts (e.g. employee commitment) when there is a greater probability for the relationship to be ongoing.

3. Enhanced firm-specific investment

An additional implication of risk management on stakeholder relationships relates to the influence it can have on the commitment of resources (e.g. from employees, customers, suppliers, managers etc) towards important firm-specific investments. From a resource-based view perspective, where the basis of competitive advantage lies in the internal tangible and intangible firm resources being effectively organised and utilized to create value, certain unique relationships are key (Penrose, 1959; Wernerfelt, 1984; Wernerfelt, 1995). It is argued that effective risk management provides a platform to incentivise key and essential stakeholders to invest in the firm in ways that facilitate specific sustainable competitive advantages, as shown in figure 2 below.

Figure 2: Firm Value through Competitive Advantage



Whilst the first argument, regarding cost of capital, has been shown to have an ERM performance implication (e.g., Berry, 2013 found that ERM adoption within the US insurance industry does indeed significantly reduce a firm's cost of capital), the second and third rationales (regarding firm performance benefits due to improved stakeholder relationships) have not received as much attention from an ERM performance perspective. These latter arguments are of particular relevance to ERM as they truly capture the transition of ERM from traditional risk management whereby the risk management focus has shifted from a defensive, risk mitigation and avoidance activity to an offensive and strategic risk-optimisation discipline. In essence, the realisation that risk-taking is unavoidable and informed risk-taking (within a defined risk tolerance or appetite) is a means to competitive advantage and thus value creation.

This paper empirically analyses the performance relationship of a unique ERM maturity rating and subsequently examines the enhanced stakeholder relationship arguments by statistically modelling and testing the moderating effects of suitable proxy variables. The study results provide further general support for the enhanced stakeholder rationales. Our study follows a similar format to Andersen (2008) with regard to testing the resource-based argument for risk management, in that we use similar proxy variables to examine the firm-specific investment rationale. We find a positive relationship between the ERM maturity rating and corporate performance. Furthermore, we observe higher performance relationships among firms operating in knowledge-intensive industries and firms with high levels of human-based intellectual capital (where the previously discussed firm-specific investments and stakeholder relationships are of particular importance). Our research also highlights that firms within our sample have, to date, realised some value from their ERM programmes, but fully expect to experience further enhanced returns in future periods, as the ERM discipline is further embedded and tested via exogenous market shocks, internal factors and maturation of ERM competencies over time.

1.4 Hypothesis Development

As previously discussed, there are many validating arguments in support of value creation as a result of ERM efforts. These arguments lead to the following hypothesis.

Hypothesis 1

Firms that exhibit higher levels of ERM maturity have improved performance and value (as measured by both Return on Assets and Tobin's Q respectively).

Anderson (2008) notes that firm knowledge, which can be utilized for sustainable competitive advantage, will often reside as deep insights acquired and maintained by individuals in different parts of the firm. As a result, innovative firms operating in knowledge-intensive industries, focused on advanced technologies, should be more dependent on the deployment of firm-specific resources and a synergistic fabric of effective stakeholder relationships. Furthermore, Anderson (2008) highlights that the intellectual capital of a firm is considered to be an essential element of corporate value creation within a knowledge-based economy. In essence, human-based knowledge along with innovation and intellectual capital are often important pre-requisites for optimising resource deployment for value enhancement, within the firm-specific investment process. It is argued that effective risk management practices act as an encouragement mechanism facilitating the important, and sometimes vital, stakeholder commitments and relationships towards firm-specific investments and value creation.

Therefore, if the ERM/performance-enhanced firm-specific investment rationale holds true, it is reasonable to expect that the performance associations of ERM are particularly notable amongst organizations that rely heavily on intellectual capital, innovation and knowledge intensity; as these types of firms are particularly reliant upon firm-specific investments and the intricate web of strong

stakeholder relationships.

These arguments lead to the following hypotheses.

Hypothesis 2

The performance and value improvement associated with ERM maturation is higher for firms that:

a) are innovation focussed

b) are in knowledge intensive industries.

c) have higher levels of intellectual capital

We hypothesise that more complex firms have a higher marginal performance improvement from engaging in ERM maturation activity. It has been noted that complex firms are more opaque and thus it is harder for outside stakeholders (e.g. investors, regulators, suppliers, customers etc.) to assess the risks to which they are being exposed (Hoyt and Liebenberg, 2011; Cohen et al., 2012). To the extent that ERM maturation acts as a signalling device to these outside stakeholders, it may serve to reduce agency costs and required risk premia when these entities are financially engaged with the firm.

It has also been noted in the literature than more complex firms are more likely to have more mature ERM in place, with significant variation in ERM activity by industry (Kleffner et al., 2003; Beasley et al., 2005). More specifically, firms engaged in banking, insurance and energy sectors have more developed ERM programmes. One might reasonably contend that these complex sectors have enhanced regulatory scrutiny such that the aforementioned signalling mechanism may have heightened importance. Finally, it should be noted that internal controls are likely to be weaker for the more complex firm (Doyle et al., 2006) and hence ERM should theoretically provide a greater benefit to these diversified firms in this regard.

These arguments lead to the following hypothesis.

Hypothesis 3

The performance and value improvement associated with ERM maturation is higher for firms which are industrially and geographically complex.

2. Methodology

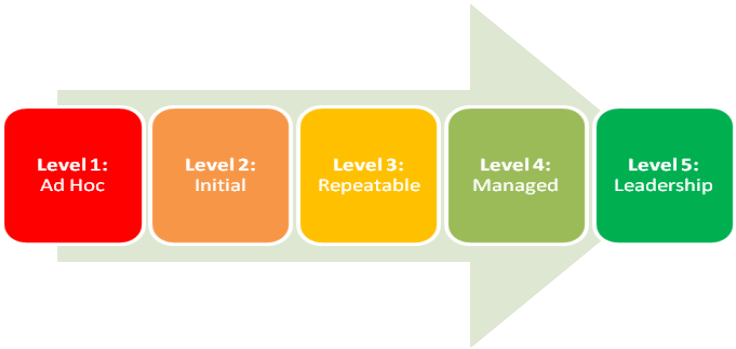
Our model specifications model both recent historic corporate performance and also firm value, as a function of ERM maturity and various other explanatory variables. We discuss the measurement of all variables below.

2.1 Measuring ERM Maturity

This empirical study is based on a sample of 230 publicly listed firms who undertook the Risk and Insurance Management Society Risk Maturity Model (RIMS RMM) online assessment over the period from 2006 to 2011.

RIMS is a not-for-profit professional association representing more than 3,500 industrial, service, non-profit, charitable and government entities throughout the world. RIMS provides networking, professional development and education opportunities to its membership of more than 11,000 risk management professionals who operate in more than 60 countries (Risk and Insurance Management Society, 2013). The RIMS RMM is a unique self-assessment methodology used to score an organization in terms of their ERM maturity rating using a unique and highly developed maturity model, which ultimately produces a 1 to 5 ERM maturity rating as shown in figure 3 below.[5]

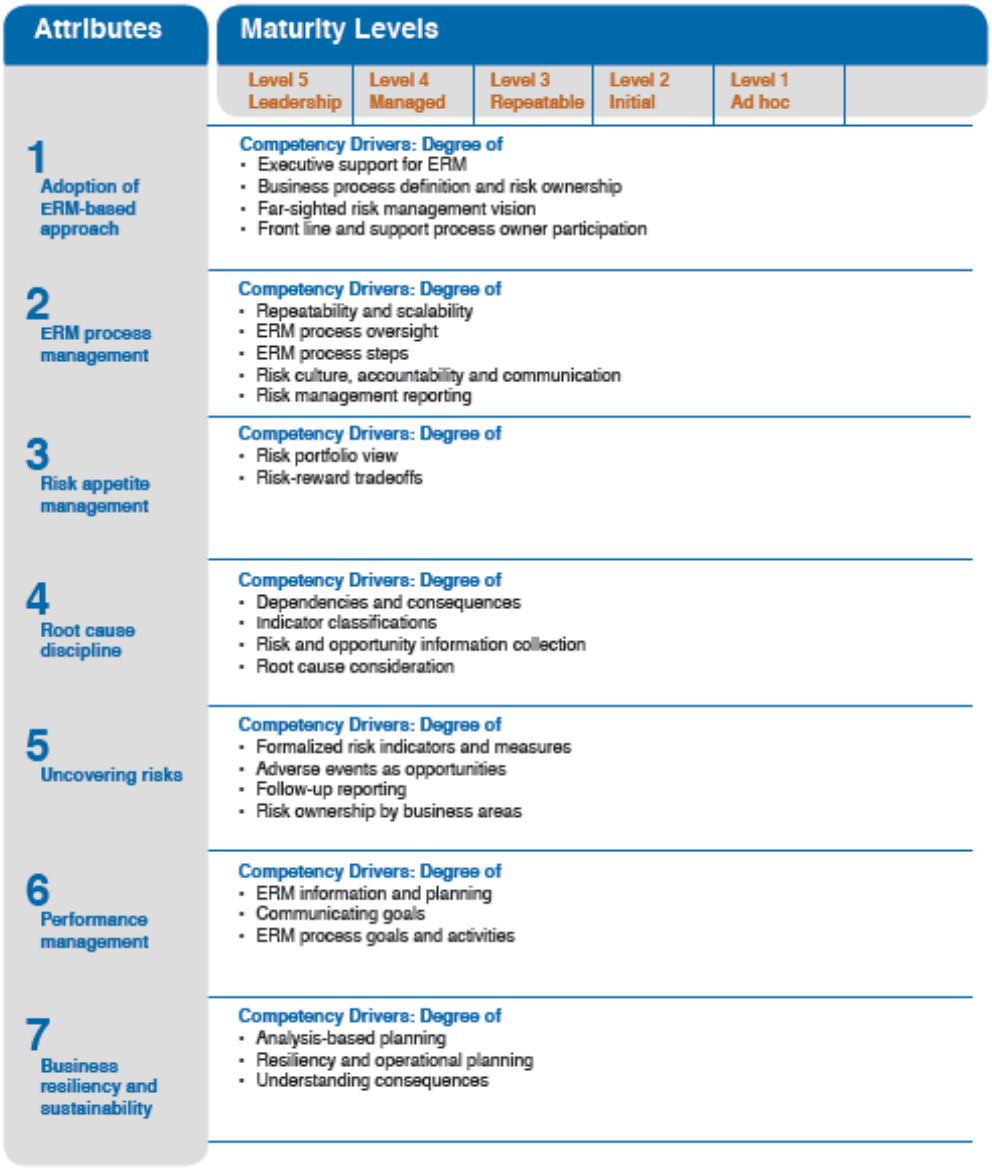
Figure 3: ERM Maturity Levels in the RIMS Risk Maturity Model



In order to classify each firm into an ERM maturity level, the model analyses performance across 7 key ERM attributes. Within each attribute, sophistication is benchmarked using a series of competency drivers. Figure 4 shows how the 1 to 5 maturity rating is arrived at via the maturity model's attributes and competency drivers.

[5] The RIMS RMM is described in further detail by Farrell and Gallagher (2014) and the Risk and Insurance Management Society (2008). It should be noted that Farrell and Gallagher (2014) use a 0/1 dummy code for ERM maturity rating whereas this study incorporates the full 1-5 maturity rating.

Figure 4: RIMS Risk Maturity Model for ERM[6]



2.2 Measuring Corporate Performance & Firm Value

In order to observe the impact of ERM maturation on the firm, we analyse two separate dependent variables: return on assets (ROA) and the natural logarithm of the Tobin's Q ratio. ROA captures the

[6] Source: Risk and Insurance Management Society (RIMS), (2008). RIMS State of ERM Report. Available from: http://www.rims.org/ERM/Pages/RiskMaturityModel.aspx (accessed August, 2018).

impact that ERM maturation has had on financial performance in the most recent accounting year whereas Tobin's Q captures the valuation impact on the company's expected future cash flows. The measures are defined as follows:

$$ROA = \text{Net Income} / \text{Total Assets} \quad (1)$$

$$\text{Tobin's Q} = (MVE+PS+D)/TA \quad (2)$$

Where:

MVE = Market value of equity
PS = Value of preferred stock
D = Debt = (Current Liabilities - Current Assets) + Long Term Debt
TA = Total Assets

All accounting and market data used in the study is sourced from Thomson Reuter's Worldscope database. It should be noted that, for consistency and data availability purposes, all financial data utilized in the study is from the financial year closest to the survey filing. For example, if a company has a December 31st fiscal year end and completed the survey on January 5th 2010, the 2009 year-end financial data is used. On the other hand, if the company had alternatively completed the survey on 15th September 2010, the 2010 financial year end data is used.

2.3 Measuring Firm Characteristics

2.3.1 General Characteristics

We measure firm size as the natural logarithm of total assets. Controlling for size is especially important since empirical evidence indicates that large firms are more likely to have ERM programs in place (Hoyt and Liebenberg, 2011) and the level of ERM maturity (i.e. our key variable of interest) may thus proxy for firm size if size is not used as a covariate.

Leverage is defined as the book value of total liabilities divided by the market value of equity at year end, and is included in line with extant ERM firm performance studies (Hoyt and Liebenberg, 2011; Farrell and Gallagher, 2014; McShane et al., 2011). The leverage variable is mean centred and standardized by its standard deviation. Leverage serves to magnify nearly all types of risk (Meulbroek, 2002). Companies with more levered capital structures have a lower equity cushion to protect against losses as well as having less financial flexibility and thus these may serve as inhibitors to effective risk management.

We posit that the returns to ERM maturity will be a function of how complex the implementing organization is. More complex organizations are more exposed to co-ordination problems that can create a dislocated framework for measuring, monitoring, reporting and ultimately dealing with risk. Thus attempts made to develop ERM systems should result in a greater marginal performance impact for these firms.

In order to measure complexity, we use the Herfindahl index in the manner of Cohen and Lou (2012). We compute the Herfindahl index along revenue segment lines, first for industrial segments and then for geographical segments. We include only firms whose aggregate revenue from all reported segments account for more than 80% of the total revenue of the firm. The latter condition ensures that the sum of all segments of a conglomerate firm in our sample is fairly representative of the entirety of the firm. In the limit, a Herfindahl index of 1 indicates that the firm derives its revenue entirely from one individual segment. As the Herfindahl measure decreases, the company becomes more diversified but more operationally complex. Variance inflation diagnostics revealed a problematic colinearity between the two separate complexity measures. As such we average the industrial and geographical Herfindahl measures to calculate an aggregate measure which is then mean centered. To facilitate more intuitive directional definition of the complexity variable, we multiply this mean centered Herfindahl by minus 1, such that a lower Herfindahl index results in a higher measured complexity.

2.3.2 Factors Affecting Firm-specific Investments and Stakeholder Relationship Importance

As previously discussed, we identified and thus measure 3 different factors which impact on the importance of an effective stakeholder relationship network and firm-specific resource deployment.

The firm's degree of innovation is measured using R&D intensity as a proxy[7] – that is costs incurred to development of new products and services as a proportion of the firm's total revenue. Innovative business environments are characterised by rapid change and considerable uncertainty and this can have ramifications for the implementation, effectiveness and value additivity of ERM deployment.

We use a dummy variable to identify those firms which operate in knowledge intensive industries. Andersen (2008) states that "in a knowledge based economy, the intellectual capital of the firm is considered an essential element of corporate value creation". To the extent that effective ERM incentivises important stakeholders to make long term commitments and contribute to the intellectual capacity of the business, this may engender value creation. The categorisation of knowledge intensive industries is done by four digit standard industrial classification (SIC) code in a manner consistent with prior literature (e.g. Andersen, 2008). Knowledge intensive industries are as follows:

Industry	**SIC Code(s)**
Pharmaceutical preparations	[SIC: 2834]
Biological diagnostics	[SIC: 2836]
Industrial machinery	[SIC: 3559]
Computer and office equipment	[SIC: 3570-3579]
Electrical equipment	[SIC: 3600-3669]

[7] R&D activities generally relate to corporate activities directed towards the development of new products and services. Hence R&D expenditure is not often intended to yield an immediate return and will have a more uncertain outcome in terms of the return on investment. See Burns et al (1961).

Semiconductors	[SIC: 3674]
Aircraft engines	[SIC: 3724]
Laboratory apparatuses	[SIC: 3821]
Analytical instruments	[SIC: 3826]
Newspapers and publishing	[SIC: 2711]
Security and commodity brokers	[SIC: 6200]
Advertising	[SIC: 7310]
Programming	[SIC: 7370]
Pre-packaged software	[SIC: 7372]
Engineering services	[SIC: 8711]
Accounting and auditing	[SIC: 8721]
Management consulting	[SIC: 8742]

We measure the company's market to book as the ratio of market value of equity to book value of equity at year end. Andersen (2008) states that this this ratio is a key indicator of how the firm can utilize its underlying assets to support its going concern value. In other words, it serves as a measure of how powerful intellectual capital can be in contributing to firm value. To the extent that effective ERM engenders an environment for thriving application of intellectual capital, the interaction may well be value additive. It is useful to note that market to book is dropped as a covariate in the specifications which have Tobin's Q as dependent variable for reasons of endogenity.

2.3.3 Fixed Effects

In order to capture industry, time and country fixed effects; we introduce a series of dummy variables to the specification. One dummy per group is omitted to avoid perfect multi-colinearity.

Industries are classified in accordance with the Standard Industrial Classification, in line with prior studies. The industrial classifications relate to the firm's primary industrial focus and are defined as follows:

Industry	**SIC Range**
Primary Industries	(SIC: 100-1731)
Manufacturing	(SIC: 2000-3990)
Transportation Services	(SIC: 4011-4731)
Telecommunications	(SIC: 4812-4899)
Retail Companies	(SIC: 5200-5990)
Financials	(SIC: 6000-6799)
Services	(SIC: 7000-8999)

Time dummies relate to the sample financial years from 2006 through 2011. Country dummies are defined as follows: Australia, Canada, United Kingdom, United States and other. Countries were included in the 'other' category if they accounted for less than 2% of the total number of observations.

As recommended by Aiken and West (1991), we center (but do not standardize) the continuous

interaction variables in our regression equation, to aid interpretation of explanatory variable coefficients. More specifically, this allows us to assess the marginal impact of ERM maturation for a hypothetical firm exhibiting average levels of innovation, complexity and market to book respectively. As a consequence, to ensure consistent interpretation, we also mean center the non-interacted innovation, complexity and market to book variables.

2.4 Specifications

Base Line Tobin's Q Specification

$$Ln(Tobin's\ Q) = \alpha_0 + \beta_1\ FirmSize + \beta_2\ Leverage + \beta_3\ Innovation + \beta_4\ KnowledgeIndustry + \beta_5\ Complexity + \beta_6\ ERM\ Maturity + \sum_{t=1}^{n} \gamma_t TimeDummies + \sum_{i=1}^{n} \mu_i IndustryDummies + \sum_{c=1}^{n} \delta_c CountryDummies + \epsilon \quad (3)$$

The baseline specification is subsequently augmented with interactions between the ERM maturity variable and the innovation, knowledge industry and complexity variables respectively, to investigate moderating influences.

Base Line ROA Specification

$$ROA = \alpha_0 + \beta_1\ FirmSize + \beta_2\ Leverage + \beta_3\ Innovation + \beta_4\ KnowledgeIndustry + \beta_5\ Complexity + \beta_6\ Market\ to\ Book + \beta_7\ ERM\ Maturity + \sum_{t=1}^{n} \gamma_t TimeDummies + \sum_{i=1}^{n} \mu_i IndustryDummies + \sum_{c=1}^{n} \delta_c CountryDummies + \epsilon \quad (4)$$

This baseline specification is also subsequently augmented with interactions between the ERM maturity variable and the innovation, knowledge industry and complexity and market to book variables respectively.

Table 1: Summary Statistics

Variable	Mean	StDev	25th Percentile	Median	75th Percentile
Ln(Tobin's Q)	-0.2598	0.7435	-0.6658	-0.1696	0.2620
ROA	0.0429	0.0466	0.0181	0.0406	0.0711
ERM Maturity Level	2.8174	0.8675	2.0000	3.0000	3.0000
Firm Size	8.7545	1.6447	7.5958	8.7186	9.8119
Leverage	0.0000	1.0000	-0.1641	-0.1031	0.0281
Innovation*	0.0140	0.0420	0.0000	0.0000	0.0000
Knowledge Industry	0.0870	0.2824	0.0000	0.0000	0.0000
Complexity*	0.3977	0.2611	0.1950	0.3987	0.5734
Market to Book*	2.3905	3.2493	0.9463	1.7632	2.8542

Table 2: Pearson Correlation Matrix

Variable	Ln(Tobin's Q)	ROA	ERM Maturity Level	Firm Size	Leverage	Innovation	Knowledge Industry	Complexity	Market to Book
Ln(Tobin's Q)	1.0000								
ROA	0.3671	1.0000							
ERM Maturity Level	0.0085	0.0561	1.0000						
Firm Size	-0.2670	-0.0165	0.2127	1.0000					
Leverage	0.0300	-0.0215	0.0506	0.0320	1.0000				
Innovation*	0.1607	-0.1040	-0.0340	-0.0298	0.0023	1.0000			
Knowledge Industry*	0.1646	0.0077	-0.0062	0.0073	-0.0103	0.6692	1.0000		
Complexity	-0.0905	0.0795	-0.0336	0.1442	-0.0216	0.1033	0.1397	1.0000	
Market to Book*	0.3672	0.1838	0.1284	-0.0882	0.3338	0.1167	0.0833	-0.0434	1.0000

*Summary statistics for these variables relate to their non-centred values for reasons of economic interpretation.

We note that the average firm sampled had a Tobin's Q of 0.7712 ($=e^{-0.2598}$) with an ROA of 4.29%. On average, firms sampled had an ERM maturity level of 2.8174 on the 1 to 5 RIMS ERM maturity scale. The level of ERM maturity is positively correlated with our measures of performance (i.e. the log of Tobin's Q and the ROA) as well as firm characteristics such as size, financial leverage and the market to book ratio.

Innovation, knowledge industry and market to book are positively correlated in all combinations.

Complexity has a positive correlation with innovation and knowledge industry but a negative correlation with market to book.

Tests for collinearity result in variance inflation factors that are sub 10 across all variables used in our specifications.

3. Results

Table 3: Results of Regression Analyses using Tobin's Q as the Dependent Variable

	Model					
Dependent Variable=LN(TQ)	**1**	**2**	**3**	**4**	**5**	**6**
Firm Size	-0.0548*	-0.0530*	-0.0501*	-0.0533*	-0.0494*	-0.0495*
	(0.0291)	(0.0293)	(0.0293)	(0.0292)	(0.0294)	(0.0295)
Leverage	0.0429	0.0432	0.0442	0.0441	0.0452	0.0452
	(0.0479)	(0.0478)	(0.0480)	(0.0493)	(0.0493)	(0.0495)
Innovation	1.4174	-0.5812	1.4628	1.5328	1.5593	2.3805
	(1.2731)	(1.8808)	(1.2364)	(1.2022)	(1.1710)	(2.1518)
Knowledge Industry	0.0465	0.0473	-0.6200*	0.0503	-0.5233*	-0.6217
	(0.2019)	(0.2031)	(0.3308)	(0.1871)	(0.2781)	(0.4181)
Complexity	-0.3365*	-0.3282*	-0.3184*	-1.2621***	-1.1465***	-1.1243***
	(0.1714)	(0.1723)	(0.1719)	(0.4214)	(0.4090)	(0.4250)
ERM Maturity	0.0883**	0.0842**	0.0612	0.0895**	0.0661*	0.0637
	(0.0374)	(0.0383)	(0.0389)	(0.0361)	(0.0385)	(0.0391)
ERM Mat * Innovation		0.7028				-0.2874
		(0.5526)				(0.8381)
ERM Mat * Knowledge Ind			0.2349**		0.2020**	0.2365
			(0.1159)		(0.1011)	(0.1683)
ERM Mat * Complexity				0.3287**	0.2932**	0.2850**
				(0.1415)	(0.1366)	(0.1438)
Constant	0.0119	-0.0034	0.4832	-0.0325	-0.0178	-0.0087
	(0.3579)	(0.3589)	(0.3253)	(0.3677)	(0.3680)	(0.3690)
Time Dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Observations	230	230	230	230	230	230
Adjusted R2	0.4362	0.4354	0.4414	0.4433	0.4464	0.4438
F-Stat	9.7966	9.2856	9.4766	9.3504	9.7164	9.4019

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In our baseline specification (model 1) we utilize the natural logarithm of Tobin's Q as our dependent variable. This allows us to examine valuation effects in terms of how the market expects the firm to be valued based upon expected future profit streams.

Using Tobin's Q, as a proxy for firm value, is appropriate as it adequately reflects market expectations, is relatively free from managerial manipulation and does not require risk adjustment or normalisation.

It can be noted that ERM maturity significantly impacts Tobin's Q and an increase in ERM maturity of one level raises the log of Tobin's Q by around 8.83% (or $e^{0.0883}$=9.23% unlogged). As such, a full maturation from the "ad-hoc" level 1 to the "leadership" level 5 is consistent with a valuation increase of around 35% ceteris paribus. This finding is consistent with Farrell and Gallagher (2014) who found a statistically significant positive valuation premium to the magnitude of 25% for firms that had reached mature levels of ERM. The result is also reasonably consistent with Hoyt and Liebenberg (2011) who found that US insurance firms undertaking ERM had a valuation premium of approximately 20%.

In models 2 to 5, we sequentially introduce interactions between the level of ERM maturity and potential moderating influences.

As seen in model 2, the innovation interaction is insignificant leaving the ERM impact in a similar range as the baseline model.

When we introduce a knowledge industry interaction (model 3), we see a statistical and economically significant positive impact of ERM maturity. For the knowledge intensive firm, the impact of ERM maturation is around 23.5% per unit of maturation higher than for those firms in non-knowledge intensive industries. Moreover, the significance of the raw ERM coefficient drops completely. This suggests that the value additivity of ERM is concentrated in knowledge intensive industries.

In model 4, we introduce a complexity interaction. Noting that the complexity variable is mean centered, we can state that a unit increase in our complexity measure, above the mean level of complexity, increases log Tobin's Q by around 32.87% (or $e^{0.3287}$=38.92% unlogged) per unit of ERM maturation. Given the definition of complexity, a unit shift is not economically feasible. A shift by one standard deviation of measured complexity (0.2611, as per table 1) above the mean complexity would increase the impact of unitary ERM maturation by around 8.61% (=32.87%*0.2611). It should be noted that in the case of the complexity interaction, the impact is additive and does not subsume the significance of the original ERM coefficient.

In model 5, we include both of our significant interactions to examine if their effects are orthogonal to one another, and find this to be the case with both retaining significance at the 5% level.

In model 6 we include all interactions. The dominant interaction is that of ERM maturity and complexity. A shift by one standard deviation of measured complexity (0.2611, as per table 1) above the mean complexity would increase the impact of unitary ERM maturation by around 7.44% (=28.50%*0.2611). The inclusion of the other interactions thus moderate the complexity impact slightly, however it still retains its significance at the 5% level.

All 6 models employed exhibit explanatory power of around 44% of the variation in the log of Tobin's Q. All specifications pass the test of joint significance.

Table 4: Results of Regression Analyses using ROA as the Dependent Variable

	Model						
Dependent Variable= ROA	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Firm Size	-0.0002	-0.0002	-0.0001	-0.0002	-0.0001	-0.0001	-0.0000
	(0.0019)	(0.0019)	(0.0020)	(0.0020)	(0.0019)	(0.0019)	(0.0020)
Leverage	-0.0070*	-0.0064	-0.0066	-0.0070*	-0.0103	-0.0063	-0.0092
	(0.0042)	(0.0041)	(0.0041)	(0.0042)	(0.0076)	(0.0041)	(0.0074)
Innovation	-0.1379	-0.9134**	-0.1795	-0.1375	-0.1301	-0.6970**	-0.6749**
	(0.1350)	(0.3624)	(0.1277)	(0.1349)	(0.1318)	(0.3317)	(0.3205)
Knowledge Industry	0.0034	-0.0002	-0.0779**	0.0033	0.0019	-0.0544**	-0.0545***
	(0.0135)	(0.0137)	(0.0306)	(0.0135)	(0.0136)	(0.0221)	(0.0208)
Complexity	-0.0133	-0.0123	-0.0133	-0.0164	-0.0122	-0.0126	-0.0083
	(0.0100)	(0.0099)	(0.0099)	(0.0292)	(0.0100)	(0.0099)	(0.0268)
Market to Book	0.0036***	0.0036***	0.0036***	0.0036***	0.0016	0.0036***	0.0018
	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0019)	(0.0002)	(0.0018)
ERM Maturity	0.0061**	0.0062**	0.0036	0.0061**	0.0062**	0.0045	0.0047*
	(0.0027)	(0.0027)	(0.0028)	(0.0027)	(0.0027)	(0.0028)	(0.0028)
ERM Mat * Innovation		0.2652**				0.1815*	0.1763*
		(0.1056)				(0.0967)	(0.0927)
ERM Mat * Knowledge Ind			0.0293***			0.0199**	0.0195**
			(0.0111)			(0.0087)	(0.0082)
ERM Mat * Complexity				0.0011			-0.0012
				(0.0095)			(0.0086)
ERM Mat * Mkt to Book					0.0010		0.0008
					(0.0010)		(0.0009)
Constant	0.0328	0.0300	0.0360	0.0326	0.0288	0.0330	0.0298
	(0.0296)	(0.0293)	(0.0292)	(0.0298)	(0.0307)	(0.0292)	(0.0305)
Time Dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	230	230	230	230	230	230	230
Adjusted R2	0.3670	0.3859	0.3858	0.3640	0.3711	0.3909	0.3904
F-Stat	19.2684	18.6955	23.0769	18.2302	71.8531	20.5395	70.7441

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In table 4, we run similar models swapping ROA for log Tobin's Q as the dependent variable. Furthermore, whilst we did not include market to book as an independent variable in the Tobin's Q specifications, for reasons of endogeneity, we are free to do so for the ROA specifications. We also take the opportunity to interact the market to book ratio (which is mean centred for previously discussed reasons) with the level of ERM maturity.

In our baseline specification (model 1), we can see that the level of ERM maturity has a significant impact upon ROA – a one level increase in ERM maturity increases ROA by 0.61%. Full maturation from level 1 to level 5 increases ROA by 2.44% (0.61%*4) which viewed against the sample average ROA of 4.29% is economically significant.

We then introduce the innovation interaction in model 2. We note that the raw innovation coefficient is negative and highly significant. Generally speaking, companies which have higher levels of

innovation than average (as proxied by R&D intensity), have a significantly lower ROA. It is interesting to note however that much of this negative impact is tempered by ERM maturation. If we take the standard deviation of the innovation variable (0.042) as a measure of an economically realistic shock to innovation, then whilst the raw innovation impact would decrease ROA by 3.83% (=-0.9134*0.042), each additional unit of ERM maturation would offset this by about 1.11% (=0.2652*0.042). The significance of this interaction does not subsume the original significance of the ERM maturity variable which retains a similar magnitude as significance as in the baseline model.

In model 3, we introduce the knowledge industry interaction and again note a significant impact. The impact of ERM maturation on ROA is higher (by 2.93% per maturation level) amongst those firms in knowledge industries. The significance of the interaction subsumes that on the raw ERM coefficient such that we conclude that the performance impact of ERM maturity is concentrated in knowledge intensive firms.

In models 4 and 5 we introduce the complexity interaction and market to book interaction respectively and find no significant impact on ROA, in each case leaving the raw ERM coefficient similar in magnitude and significance as in the baseline model.

In model 6, we re-run our specification to include both significant interactions i.e. innovation and knowledge industry. We include both to see if the interacted effects are distinct or subsets of one another. We note that both coefficients retain significance with slightly smaller marginal impacts on ROA. The negative ROA impact of larger levels of innovative activity is tempered by more mature ERM. A standard deviation level shock to the innovation level of the average firm would result in a fall in ROA by 2.93% (=-0.6970*0.042). This is offset by about 0.76% (=0.1815*0.042) per level of ERM maturation. Firms in knowledge industries have lower levels of ROA by about 5.44%, however again this negative ROA impact is tempered by ERM maturation by about 1.99% per level.

The various specifications explain in the range of 36 to 39% of the variation in ROA and all specifications pass the test of joint significance.

Table 5, therefore, summarises the three hypotheses decisions, for both ROA and the natural log of Tobin's Q.

Table 5: Summary of Hypotheses Results

Hypothesis #	Hypothesis	Decision for log Tobin's Q Specification	Decision for ROA Specification
1	Firms that exhibit higher levels of ERM maturity have improved operating performance and higher firm value.	Accept	Accept

2	The operating performance improvement and value additivity of ERM maturation is higher for firms that: a) are innovation focussed b) are in knowledge intensive industries c) have higher levels of intellectual capital	 Reject Accept NA	 Accept Accept Reject
3	The operating performance improvement and value additivity of ERM maturation is higher for firms which are industrially and geographically complex	Accept	Reject

4. Discussion of Results

The empirical evidence presented in the previous section demonstrates a clear link between ERM maturity and improved performance outcomes, be those outcomes measured by accounting based parameters (ROA) or forward looking market based measures (Tobin's Q).

In our baseline model, unitary improvement to ERM maturity increases ROA by 0.61% (economically significant when compared with a sample average ROA of 4.29%). Our ROA/table 4 findings are similar to that of Baxter et al. (2013) who found that a one-level increase in ERM quality measure ranging from 1 (low) to 6 (high), using Standard & Poor's (S&P) Ratings Direct, was associated with a 1.14% increase in ROA.

The same unitary improvement in ERM maturity boosts Tobin's Q by around 9.23%. As such full maturation from an "ad-hoc" level of ERM to a "leadership level" is associated with a 37% valuation increase. Baxter et al. (2013) also modelled the impact of ERM quality on Tobin's Q and found a significant increase of 3.88% for each of the 5 S&P rating movements. This points to an overall potential movement of 19.4% for full S&P ERM rating maturation, compared to our 37% valuation increase for full RIMS RMM progression.

Mature ERM (as per the RIMS RMM) is defined by: strategic integration of the ERM agenda with the broader corporate strategy, commitment to ERM from the top of the firm, clear reporting of enterprise risks, a portfolio approach to risk management and effective ownership of risk amongst stakeholders as well as other features. The source of value additivity of such processes has been a source of debate amongst scholars and corporate executives alike. Whilst most explanations focus on the interface between the corporation and its stakeholders, there is disagreement as to the source and relative importance of the stakeholder impacts.

Some assert that the primary channel for improved performance outcomes stems from the reduction in earnings variability and operational volatility brought about via effective management of risk. As a result, it is claimed that providers of debt and equity capital to the firm, lower their required risk premium and hence reduce the firm's cost of capital. This brings with it added capacity to take positive net present value projects, which deliver long term shareholder value.

Others take a broader stakeholder view whereby the focus is not on the cost of capital, but rather on whether the corporate culture incentivizes key stakeholders to make long term commitments to the firm. To the extent that a sophisticated risk based culture can engender the incubation, development and implementation of long term projects, it can encourage key stakeholders (e.g. employees, suppliers, customers, regulators) to make the commitments that can lead to value creation and an economic advantage.

To some extent, the finding of a positive valuation impact around ERM maturation could be attributed to either of the schools of thought. Perhaps, more suitably, the interaction of both may explain the value additivity. If we are to view firm value in the traditional financial context, the calculation of value is rooted in projecting future cash flows of the firm and discounting these at a rate that is commensurate with the risk to which capital providers are exposed. Whilst the stakeholder view of the firm speaks to fostering a culture of long-term commitment and broad enfranchisement of stakeholders, these may lead to superior future cash flows stemming from long term competitive advantage. Coupled with a reduction in perceived risk of these cash flows, they are discounted less heavily by the market, thus reinforcing the value additivity.

Whilst our Tobin's Q measure is forward looking and market focused, analyzing the impact of ERM maturation on ROA gives us a more immediate sense of its benefits, in terms of actual recent historic realized returns. The capacity of firms with mature ERM to generate income and cash flows from their asset bases is materially improved. This may also speak to the ability of the firm to exploit competitive advantage, improving their top line whilst minimizing funding cost expenses.

In order to delve deeper into the types of firms that have the highest improvement in performance outcomes, resultant from ERM maturation, we expanded our specifications to capture other firm-specific characteristics that are associated with the broader stakeholder perspective of ERM value additivity. In other words, the types of firms which rely more heavily on a fabric of strong stakeholder relationships in order to build firm-specific investments that ultimately create firm value.

We look at the interaction between ERM maturity and innovation on performance outcomes. The importance of stakeholder engagement is heightened in R&D intensive industries where the development of new products and technologies is often complex, specialized, disruptive and competitive. The interface of the firm with a broad stakeholder group which includes customers, suppliers, regulators, consultants, licensing entities, amongst others, mandates heightened levels of long-term commitment from key actors. To the degree that more sophisticated ERM facilitates the engagement of these key actors, we hypothesized that it should be associated with positive performance outcomes. Whilst we did find evidence of a positive and significant interactive performance outcome in our accounting based ROA measure, we did not find a significant interactive impact upon Tobin's Q. The ERM associated performance improvement for firms in innovation focused industries appears to be quite immediate, improving the efficiency with which the firm utilizes assets to create bottom line net income. The long-term market valuation impact of this ERM maturation is more muted.

We also investigate whether the performance outcomes linked with ERM maturity are concentrated in industries that are defined as knowledge intensive (e.g. pharma, aeronautics, electronics, management consulting). To the degree that a firm invests its resources in a knowledge intensive environment, the outcome can lead to sustainable competitive advantage. However, the use of rare,

complex and idiosyncratic knowledge brings with it considerable challenges: not least in ensuring that the organization is built in such a way as to allow the benefits of its knowledge capital to cascade throughout the firm. Furthermore, knowledge intensive environments also demand the mediation between various sources of high value unique knowledge that taken in sum can provide enormous competitive edge. Key actors at firms in these industries must be enfranchised to the extent that that they are willing to commit fully to the stakeholder relationship, keep their knowledge set current and are willing to deploy this knowledge in a meaningful and long termist way. We, therefore, hypothesized that a mature ERM framework provides an environment in which key stakeholders in knowledge intensive industries can thrive.

Empirically, the interaction between ERM maturity and knowledge intensive industries is associated with improved performance outcomes at both the more immediate financial statement level (ROA) and the forward looking market based level (Tobin's Q). From a valuation perspective the impact of ERM maturation is around 23.5% per unit of maturation higher for the knowledge intensive firm than for those firms in non-knowledge intensive industries. The impact of ERM maturation on ROA is 2.93% per maturation level higher amongst those firms in knowledge industries than non-knowledge industry firms.

We also examine another facet of stakeholder investment and engagement in the firm by looking at the interaction between ERM maturity and intellectual capital. The latter is proxied by the ratio of the market value of the firm to the book value of its net assets and the rationale for the proxy is that the book value of net assets focuses primarily on physical assets (e.g. property, plant and equipment). These are generally measured at historical cost minus accumulated depreciation. However, this is merely a point in time (balance sheet date) valuation and does not take into account future growth projections that result from successful investment of assets within the business. If we look at the market value of the business as measured by its stock market capitalisation, this captures not just future growth prospects but also the returns to intellectual capital that help generate this growth. Thus, the higher the ratio of market to book, the more central intellectual capital is to the value of the firm. Once again, our hypothesis is that for intellectual capital to thrive and lead to value additive growth it should go hand in hand with more sophisticated ERM. Owing to empirical restrictions, this hypothesis could be tested only on our financial statement performance outcome (ROA), and the test did not reveal a significant interaction.

Finally we examine whether performance outcomes associated with ERM maturation are impacted by the level of complexity of the firm involved. Our complexity proxy is a compound measure of how industrially and geographically complex a firm's revenue base is.

Our prior hypothesis states that improved ERM maturation is of heightened importance for firms that are more complex and exposed to a greater variety of operational and financial risks. Empirically we find that there is a differential level of relationship between ERM and performance outcomes across the

complexity spectrum, although this difference is present only in the market based Tobin's Q specification and not in financial statement based ROA specification.

We contend that the difference may relate to the nature of our dependent variables - more specifically, the operational and financial risks associated with complexity may not become apparent in any one reporting year. Yet over the corporate lifetime they may be very evident indeed. As such the forward looking market based measure may be more finely tuned to the long-term risk exposures of the business, and efforts to manage these risks respectively.

5. Study Limitations

There are several areas of this study which we feel are subject to limitations and hence should be noted. The first of these relates to the way in which ERM maturity is measured. Whilst the RIMS RMM is a market leading and successful model, the calculation of the maturity level is based upon survey answers that are self-reported and as a consequence may be exposed to respondent bias. Furthermore, the computed ERM maturity scores are conditional on the fact that the respondent has an adequate level of strategic knowledge of risk practices and attitudes right throughout the entire organization. This assumption may not be reasonable for all firms, particularly for the larger and more complex firm. In order to address these shortcomings one such method would be to visit a representative subset of the organizations involved in the study by way of independent verification of the survey responses, in addition to collecting data as to ERM processes at various levels throughout the organization.

6. Concluding Comments

Clearly the practice of risk management is undergoing a paradigm shift, as the global commercial business landscape continues to evolve at a rapid pace. Enterprise Risk Management is a maturing discipline that aims to help organizations proactively and effectively deal with the ever changing risk exposures and resulting strategic planning requirements.

Recent academic research has suggested that tangible value is being generated by companies fully engaged in the ERM process and this study supports the relationship. Additionally, certain key firm characteristics point towards an increased reliance on the ERM process. Both the complex firm (from both an industrial and geographical perspective) and the firm that is particularly reliant upon building effective stakeholder relationships, in order to best develop and utilize firm-specific investments, have much to gain from integrating their risk management efforts under a consistent ERM framework which seeks to optimize the entity's strategic risk-return decision making capabilities.

Whilst research on the valuation impact of ERM has increased over the last decade, there are still many key areas that would benefit from further research. Given the findings on moderating ERM

variables in this study, we would suggest that similar research is carried out with a much larger sample size. Furthermore, it would be a worthwhile endeavor to undertake further research that does not rely upon self-reported measures of ERM. This would be particularly helpful to overcome the concerns around survey respondent bias that may be evident. This study controlled for the timing of the survey response, however further research could be undertaken which more explicitly examines the impact which the business cycle may have upon ERM maturity and value. Finally, as ERM is still in a transitionary phase, companies are expected to increasingly move towards the upper echelons of maturity. More up to date research will, therefore, progressively reveal the true effect of ERM on company's short and long-term value and further highlight the moderating influences of the discipline.

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